



wherein:

M is a cation of a metal selected from the group consisting of Fe, Mn, Co, Ti, Ni or mixtures thereof;

D is a metal having a +2 oxidation state selected from the group consisting of  $\text{Mg}^{2+}$ ,  $\text{Ni}^{2+}$ ,  $\text{Co}^{2+}$ ,  $\text{Zn}^{2+}$ ,  $\text{Cu}^{2+}$ , and  $\text{Ti}^{2+}$ ;

T is a metal having a +3 oxidation state selected from the group consisting of  $\text{Al}^{3+}$ ,  $\text{Ti}^{3+}$ ,  $\text{Cr}^{3+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Mn}^{3+}$ ,  $\text{Ga}^{3+}$ ,  $\text{Zn}^{3+}$ , and  $\text{V}^{3+}$ ;

Q is a metal having a +4 oxidation state selected from the group consisting of  $\text{Ti}^{4+}$ ,  $\text{Ge}^{4+}$ ,  $\text{Sn}^{4+}$ , and  $\text{V}^{4+}$ ;

R is a metal having a +5 oxidation state selected from the group consisting of  $\text{V}^{5+}$ ,  $\text{Nb}^{5+}$ , and  $\text{Ta}^{5+}$ ;

X comprises Si, S, P, V or mixtures thereof;

$0 \leq x \leq 1$ ; and

$0 \leq d, t, q, r \leq 1$ , where at least one of d, t, q, and r is not 0.